Serial new high-temperature superconductors $[(C_nH_{2n+1})_4N]_xFeSe$ (n=2,3,5,6,7,8) synthesized by electrochemical intercalation

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Electrochemical intercalation allows quaternary ammonium cations (e.g. CTA+, TBA+ and TMA+) to be effectively inserted between FeSe layers, achieving a maximum T_c~50 K and an interlayer distance of up to 15.5 Å [1~3]. Building on this approach, we explore a series of new FeSe-based high-temperature superconductors $[(C_nH_{2n+1})_4N]_xFeSe$ (n=2,3,5,6,7,8), enabling broad tunability of the spacing between adjacent FeSe layers beyond 10 Å and all exhibiting T_c above 40 K. Among them, $(THA)_xFeSe$, i.e. $[(C_6H_{13})_4N]_xFeSe$ shows a T_c of up to 45 K and a *c*-axis lattice parameter reaching 18.4 Å—the largest interlayer distance of FeSe-based superconductors with ~100% diamagnetic shielding so far. These materials offer promising platforms for studying the relationship between interlayer coupling, superconducting fluctuations and superconductivity.

References

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